

The FHWA Travel Model Improvement Program Workshop over the Web

The Travel Model
Development Series:
Part I –
Travel Model Estimation

presented by
Thomas Rossi
Yasasvi Popuri
Cambridge Systematics, Inc.

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Webinar Outline

- Session 1: Introduction – October 16, 2008
- Session 2: Data Set Preparation – November 6, 2008
- Session 3: Estimation of Non-Logit Models – December 11, 2008
- Session 4: Estimation of Logit Models – February 10, 2009

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Webinar Outline (continued)

- Session 5: Disaggregate and Aggregate Validation Procedures – March 12, 2009
- Session 6: Advanced Topics in Discrete Choice Models – April 14, 2009
- Session 7: Highway and Transit Assignment Processes – May 7, 2009

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Webinar Outline (continued)

- Session 8: Evaluation of Model Validation Results – June 9, 2009
- Session 9: Real Life Experiences in Model Development, Webinar Wrap-Up – July 16, 2009

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Outline for Today

1. Highway Assignment
2. Introduction of Homework
3. Transit Assignment

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Trip Assignment

- Trip assignment is route choice
- Directly considers the choices made by other travelers
- Typically is an aggregate process
- Time periods defined for the model
 - e.g. AM peak, PM peak, midday, evening

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Highway Assignment

- Input: Vehicle trip tables for each time period, perhaps by class
 - SOV
 - HOV
 - Truck
 - Toll road users?
- Input: Highway network (by class)
- Outputs: Link traffic volumes and speeds by time period (by class)

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Static User Equilibrium Assignment

- Travel time is a function of free flow travel time, volume, and capacity
- Volume is a function of travel time
- Travelers seek to minimize their travel times (or costs)
- Equilibrium is reached when no traveler can improve his travel time

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Equilibrium Assignment

Practical Considerations

- Implemented as a weighted average series of all-or-nothing assignments
- Each modeling software package has its own algorithms for computing equilibrium
 - Computing shortest paths
 - Computing weights
- Convergence measures
- Comparisons of scenario results

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Highway Assignment

User Settings

- Convergence/number of iterations
- Definition of impedance function
 - Time
 - Distance
 - Cost
 - What is not included
- Hourly/period conversion factor

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Volume-Delay Functions

$$T_k = f(T_{0k}, v_k, c_k)$$

“BPR formula”

$$T_k = T_{0k} [1 + a (v_k/c_k)^b]$$

where:

T_k = travel time on link k

T_{0k} = free flow travel time on link k

v_k = volume on link k

c_k = capacity on link k

a, b = model parameters

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The BPR Formula

- Parameters a, b are not estimated
 - May be borrowed from another model
 - May be asserted
 - May be revised during calibration
- Higher a increases sensitivity of time for lower v/c
- Higher b increases sensitivity of time for higher v/c
- May vary among links (e.g. by facility type)

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The BPR Formula

Examples of parameters:

a	b
0.07	6.0
0.10	4.0
0.15	4.0
0.15	8.0
0.68	5.5
0.71	2.1

a	b
0.83	2.7
0.83	7.0
0.88	9.8
1.00	5.4
1.16	6.0
1.50	5.0

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Other Volume-Delay Functions

- Improvements to accuracy or computational efficiency
 - Akcelik formula
 - Conical function
- Consideration of additional variables
 - HCM based functions
- Node based delay

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Multi-Class Assignment

- Provides link volumes for different vehicle classes
 - SOV
 - HOV
 - Truck
- Allows consideration of:
 - Priority lanes (e.g. HOV)
 - Prohibitions (e.g. trucks)

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Multi-Class Assignment

- Travel modeling software can handle this directly
- Required inputs:
 - Trip tables for each class
 - Definitions of which links are allowed/prohibited for each class

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Some Highway Assignment Questions

- Why are roads assigned above capacity?
 - Capacity is an abstract concept
 - “Saturation flows” have increased
 - The trips all have to be assigned

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Some Highway Assignment Questions

- Can peak spreading be handled directly by...
 - Static equilibrium assignment?
 - No
 - Traffic simulation?
 - No, only spillover to later periods
 - Post processors?
 - Only in a manual, rule based manner
 - Time of day choice models?
 - Yes, in theory
 - Activity based models?
 - Yes, but need data to calibrate

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Some Highway Assignment Questions

- How can link volumes/times be affected by other links?
 - Intersections (including opposing left turns)
 - Merges/weaves
 - Queuing/spillover
- How can link interactions be handled?
 - Node based delay
 - Traffic simulation

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Homework

Session 7

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Transit Assignment

Decisions for the Modeler

- Network decisions
 - Relationship between bus and highway speeds
 - Fare representation
 - Coding decisions
- User settings
- Single path vs. multipath

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Transit Assignment

User Settings

- Relative weights of level of service variables
 - In-vehicle time
 - Walk/wait time
 - Transfer penalty
 - Consistency with mode choice model parameters
 - How do you get skims with which to estimate the mode choice model?
- Walk/auto access rules

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Transit Assignment User Settings (continued)

- Other rules
 - Maximum number of transfers
 - Wait time limits
 - Transfer walk limits
 - Maximum trip time
 - Minimum in-vehicle trip times

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Transit Assignment Implications of User Settings

- No transit service for some O-D pairs could result from:
 - Maximum travel times
 - Maximum walk or auto access/egress times
 - Maximum number of transfers
 - Minimum in-vehicle time
- Inconsistencies between scenarios

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Single Path vs. Multipath Transit Assignment

- Definition of path:

The sequence of links and nodes, including walk/auto access and egress portions of trip, used to travel from the origin centroid to the destination centroid
- This defines the routes taken, in order, and the boarding, alighting, and transfer stops.

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Single Path vs. Multipath Transit Assignment (continued)

- Single path advantages
 - Simpler
 - Accurate for simple transit networks
- Multipath advantages
 - Only way to get accurate route boardings in less simple networks
 - Supported by most modeling software

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Inaccurate Single Path Results Example

Route A – 15 min headway
A 8:30 ————— B

Route B – 15 min headway
A 8:35 ————— B

Route C – 15 min headway
A 8:32 ————— B

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Inaccurate Single Path Results Example

Route A – 15 min headway
A 8:30 ————— B —————

Route B – 15 min headway
A 8:35 ————— C

Route C – 15 min headway
A 8:32 ————— B —————

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Single Path vs. Multipath Transit Assignment

- Decision factors
 - Software options
 - Complexity of transit network
 - Mode definitions in mode choice model
 - Desired outputs (route and stop level boardings)

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Schedule Based Transit Assignment

- Current procedures are headway based
 - Trips not assigned to particular transit runs
- Schedule based assignment
 - Assigns trips to particular runs/vehicles
 - More accurate representations of wait times/transfer times, etc.
 - Requires mode detailed time of day travel information
 - Well suited for implementations with activity based models

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